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SEASONAL DISTRIBUTION OF SOME *HALIMEDA* SPECIES (CHLOROPHYCEAE) IN TIRUNELVELI REGION IN THE SOUTH EAST COAST OF TAMIL NADU, INDIA

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ABSTRACT

The purpose of the investigation was to study the seasonal variability of *Halimeda* species collected from Thoothukudi region in the south east coast of Tamil Nadu, India. *Halimeda* species were collected in various seasons namely summer, pre-monsoon, monsoon and post-monsoon from intertidal and subtidal regions up to 1m depth. *Halimeda* species were enumerated at random using a quadrate ($0.5m^2$). A total of three species of *Halimeda* were collected in the study area such as *Halimeda copiosa*, *Halimeda macroloba* and *Halimeda tuna.* The frequency and density were calculated and all the *Halimeda* species showed a similar pattern of seasonal variation. Among the seaweeds collected the highest frequency (69.75%) and density (5.60) were observed in *Halimeda tuna* during summer season and the lowest frequency (22.50%) and density (1.83) were recorded in *Halimeda copiosa* during post-monsoon season. All the *Halimeda* species (Chlorophyceae) showed the maximum frequency and density during the summer season followed by the declined trend was observed during the pre-monsoon and monsoon seasons in the present study. During the post-monsoon season the frequency and density of *Halimeda* species (Chlorophyceae) was minimum in Tirunelveli region of the south east coast of Tamil Nadu, India.

Keywords: Green seaweed, *Halimeda,* Quadrate, Frequency, Density.

INTRODUCTION

Through four billion years of evolution, life on earth has expanded to almost infinite diversity with each species interacting with others and molding itself to its habitat until a global ecosystem developed. Seaweed beds are communities consisting of large benthic marine macro algae as primary producers and form rich marine meadows and forests. Seaweeds play an important role in the ecosystem of the coastal areas serving as nursery grounds for fish and shellfish, such as egg laying sites and feeding grounds. Therefore, seaweed beds may contribute to the maintenance of both biodiversity and natural environments on earth [1]. It was accepted that the seaweed species occurring along the south east coast of Tamil Nadu, India can be assigned to one of three groups conveniently distinguished by the colour, pigmentation, reserved food materials and nature namely green (Chlorophyceae), brown (Phaeophyceae) and red (Rhodophyceae).

The green seaweeds are found in shallow water where they are able to make the best use of sunlight and grow better than those of other species. Green seaweeds include the bright green sea lettuce with *Ulva* species growing in continuous sheets while others are delicately perforated and net like. They are much sought after by grazing fish and molluscs and are often found at the water's edge at low tide [2]. Another green seaweed in shallow waters is *Enteromorpha* spp. Its bright green sheets often form hollow tubes and may appear filamentous, but others are more like deflated balloons [3]. The seaweed *Chaetomorpha* species is common in rock pools where it resembles tangled masses of thick, bright green nylon fishing line [4]. Each of these three green seaweed groups is highly resistant to changes in salinity and temperature and can cope with the wide range of conditions encountered in the intertidal zone.

The green seaweed that has exerted the greatest effect on the south east coast of Tamil Nadu, India is *Halimeda* which is represented by several species, all with rather oval, fleshy leaves impregnated with calcium carbonate. *Halimeda* species forms thick, grayish green mats, ten or more centimetres deep in the subtidal region which crunch as during walk over on the species. The calcium carbonate of any that are eaten by herbivores is not digested and passes out as a fine white sand. This accumulates together with the thick layer of bleached skeletons of dead *Halimeda* to form what are often erroneously referred to as white coral sands. In the present

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study an attempt has been made to investigate the seasonal variability of *Halimeda* species collected from Tirunelveli region in the south east coast of Tamil Nadu, India.

MATERIALS AND METHODS

In the present study, the Tirunelveli region in the south east coast of Tamil Nadu, India was selected to analyze the seasonal variability of the important green seaweed *Halimeda*. Tirunelveli region extends from Kootapuzhi in the south to Koothankuzhi in the north. Survey was carried out regularly from June 2013 to May 2014. For the sake of convenience and easy interpretation, the calendar year was divided in to four seasons viz. post-monsoon (January to February), summer (March to June), pre-monsoon (July to September) and monsoon (October to December) seasons. The entire study area was divided in to four stations namely Kootapuzhi (S_1), Perumanal (S_2), Idinthakarai (S_3) and Kootapuzhi (S_4). The survey of green seaweed *Halimeda* species from the intertidal area was carried out during low tide [5].

For the sampling of *Halimeda* transect lines, a quadrat ($0.5m^2$) was used. Plant samples were selected at random as per the requirement. This was carried out by selecting sampling points in the area using quadrat. Sampling points were selected in such a manner that every species of the study area has good chance of being selected. The number of quadrats was determined as per the area selected. For this purpose the whole station (For example station S_1) was separated into four segments namely segment A, segment B, segment C and segment D. Quadrats were placed every three meters on four segments. Each segment was 250m long in which 80 quadrats were placed. Monthly 160 quadrats were taken and the number varying according to the tidal height. *Halimeda* species present in the quadrats were observed, collected, counted species wise and number of individuals in each species was noted for quantitative assessment of frequency and density. The seasonal variability of *Halimeda* species were represented in seasonal wise [6]. For the estimation of frequency and density the following formulae were used Frequency: Total number of quadrats in which species occurred / Total number of quadrats studied Density: Total number of species / Total number of quadrats studied

RESULTS AND DISCUSSION

Totally three *Halimeda* species namely *Halimeda copiosa* Goreau & E.A. Graham (Figure 1a), *Halimeda macroloba* Decaisne (Figure 1b) and *Halimeda tuna* (Ell. *Et.* Sol.) Lamour (Figure 1c) were collected in Tirunelveli region in the south east coast of Tamil Nadu, India and all the *Halimeda* species found in the study area were observed throughout the year. Though all the members of *Halimeda* showed closely related patterns of seasonal distribution, with respect to frequency and density high level of variability was observed between the seasons and stations. Among the four seasons studied, all the taxa of *Halimeda* were observed during summer with the highest frequency and density in the selected study area. A well marked declining in the frequency and density were recorded in the subsequent seasons of pre-monsoon and monsoon. The post-monsoon season was noted to be poor growth of *Halimeda* members which showed the lowest frequency and density in the present study.

Among the *Halimeda* species which were observed in all the four stations, the species *Halimeda tuna* showed the highest frequency (69.75%) and the species *Halimeda copiosa* showed the lowest frequency (31.25%) during summer in Tirunelveli region. Whereas, during the post-monsoon season *Halimeda tuna* was observed to be the highest frequency (61.25%) and *Halimeda copiosa* was with the lowest frequency (22.50%) followed by *Halimeda macroloba* with 43.75% frequency. During pre-monsoon season, the highest frequency was recorded in *Halimeda tuna* (68.75%) and the lowest frequency in *Halimeda copiosa* (28.75%) followed by *Halimeda tuna* with the highest frequency (63.75%) and *Halimeda copiosa* (25.00%) with the lowest frequency during the monsoon season as shown in Table 1 and Figure 2.

Though the members of *Halimeda* species showed the similar pattern of seasonal distribution, high level of the variability was observed with respect to density between the seasons and stations. In *Halimeda* species, *Halimeda tuna* showed the highest density (5.60) and the lowest density (2.15) was recorded in *Halimeda copiosa* during summer season. The rate of density was increased from post-monsoon to summer. *Halimeda copiosa* showed the lowest density (1.83) and the highest density (5.31) was observed in *Halimeda tuna* at post-monsoon season. During the pre-monsoon season, *Halimeda tuna* was found to be with the highest density (5.48) and *Halimeda copiosa* with the lowest density (2.03). *Halimeda tuna* was observed with the highest density (5.38) and *Halimeda copiosa* was found to be with the lowest frequency (1.95) during monsoon season (Table 2 and Figure 3).

Seaweeds from natural populations have been used since the beginning of civilization for food, feed, fertilizers, medicines and pharmacological activities [7]. This has led to cultivation of this resource and extension of its use for industrial chemicals such as agar, alginate, carrageenans and fucerellans [8]. Seaweeds are ecologically, commercially and nutritionally valuable as fresh or dried vegetables or as ingredients in a wide variety of prepared foods [9]. In particular, certain edible seaweeds contain significant quantities of carbohydrates, proteins, lipids, minerals and vitamins [10-12], although the nutrient contents vary with species, geographical location, season and temperature [13, 14]. Indian seaweeds are of great food value and certain seaweeds contain 16 to 30% proteins on dry weight and have all essential amino acids which are not available in vegetable food materials. The nutritional potential of seaweeds as food protein sources differs according to the species. The highest protein content is recorded for red seaweeds, brown seaweeds and green seaweeds [15-17].

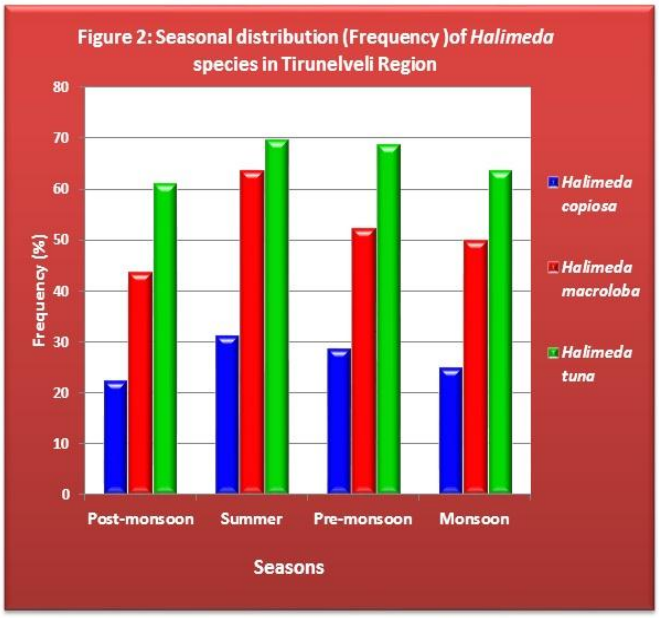
It is very important to note that the biochemicals in seaweeds show much variation seasonally due to various environmental and ecological factors. Moreover the collection of the particular seaweed at a particular place is also very difficult task to achieve. There are very less work have been carried out worldwide for the seasonal variation

of the seaweed resources and the distribution. From the present observations, it was noted that both frequency and density of *Halimeda* species varied with seasons. All the taxa of *Halimeda* exhibited a uniform pattern of increase in frequency and density during summer followed by decrease in frequency and density in the successive seasons namely pre-monsoon and monsoon season. During the post-monsoon season both frequency and density of *Halimeda* species came down and showed very less distribution compared to other seasons.

Figure 1a.
***Halimeda copiosa* Goreau & E.A. Graham**

Figure 1b.
***Halimeda macroloba* Decaisne**

Figure 1c.
***Halimeda tuna* (Ell. *Et.* Sol.) Lamour**



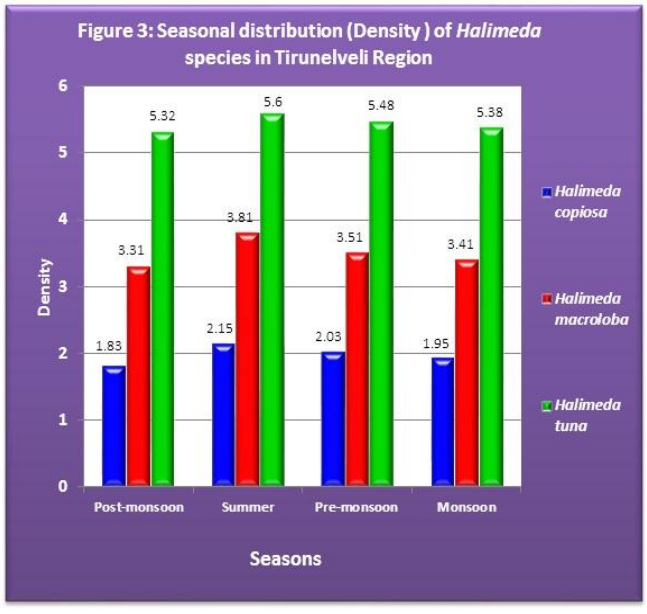


Table 1. Seasonal variability of *Halimeda* species (Chlorophyceae) in Tirunelveli region of the south east coast of Tamil Nadu, India

S.No.	Name of the Seaweeds	Post-monsoon		Summer		Pre-monsoon		Monsoon	
		F	D	F	D	F	D	F	D
1	*Halimeda copiosa*	22.50	1.83	31.25	2.15	28.75	2.03	25.00	1.95
2	*Halimeda macroloba*	43.75	3.31	63.75	3.81	52.50	3.51	50.00	3.41
3	*Halimeda tuna*	61.25	5.32	69.75	5.60	68.75	5.48	63.75	5.38

F- Frequency D- Density

CONCLUSION

It was concluded that both frequency and density of all the *Halimeda* species varied with seasons such as summer, pre-monsoon, monsoon and post-monsoon. All the taxa of *Halimeda* exhibited an uniform pattern of increase in frequency and density during summer followed by decrease in frequency and density in the successive seasons namely pre-monsoon and monsoon seasons. In the post-monsoon season, all the *Halimeda* species were observed with the lowest frequency and density. And the rate of increase or decrease of frequency and density varied with taxa and seasons.

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